IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Borran et al.
Title:	METHOD AND APPARATUS TO ESTABLISH CONSTELLATIONS FOR IMPERFECT CHANNEL STATE INFORMATION AT A RECEIVER
Appl. No.:	10/523,167
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AMENDMENT AND REPLY UNDER 37 CFR 1.116

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Commissioner for Patents
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Sir:

This communication is responsive to the Final Office Action dated July 10, 2009, concerning the above-referenced patent application, making September 10, 2009, two-months from the mailing date. Accordingly, this response is timely filed within the advisory period.

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this document.

Remarks/Arguments begin on page 6 of this document.

Please amend the application as follows:

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1.-25. (Canceled)

26. (Currently amended) A method for processing a received signal, the method comprising:

selecting a signal constellation, at a communication device, based on a channel state information and based on a current signal to noise ratio;

receiving a modulated signal at a receiver of the communication device; and

demodulating the modulated signal at a detector module of the communication device by selecting a point from the selected signal constellation corresponding to the modulated signal.

27. (Canceled)

28. (Currently amended) The method of claim 26, wherein the modulated signal is received by multiple receive antennas.

29. (Previously Presented) The method of claim 26, further comprising decoding the demodulated signal using an outer code that includes codes over a plurality of signal matrices across time.

30. (Currently amended) The method of claim 26, further comprising transmitting an indication of [[a]] the current signal to noise ratio from the communication device to a second communication device.

31. (Previously Presented) The method of claim 26, further comprising storing a plurality of signal constellations in a memory of the communication device.

32. (Previously Presented) The method of claim 26, wherein the signal constellation is designed based on a minimum Kullback-Leibler distance between signal constellation points.

33. (Previously Presented) The method of claim 26, wherein demodulating the modulated signal comprises performing maximum likelihood demodulation.

34. (Previously Presented) The method of claim 26, wherein the demodulating the modulated signal comprises performing coherent demodulation.

35. (Currently amended) A network element comprising:

a receiver module corresponding to an antenna, wherein the receiver module is configured to receive a modulated signal from a second network element; and

a detector module configured to select a signal constellation based on a channel state information and based on a current signal to noise ratio and to demodulate the modulated signal by selecting a point from the signal constellation corresponding to the modulated signal.

36. (Canceled)

37. (Previously Presented) The network element of claim 35, further comprising multiple receiver modules corresponding to multiple receive antennas, wherein the multiple receiver modules are configured to receive the modulated signal.

38. (Currently amended) The network element of claim 35, wherein the detector module is further configured ~~to produce a demodulated signal by demodulating the modulated signal; and~~ to decode the demodulated signal using an outer code that includes codes over ~~several~~ a plurality of signal matrices across time.

39. (Currently amended) The network element of claim 35, further comprising a transmit module configured to transmit an indication of [[a]] the current signal to noise ratio.

40. (Previously Presented) The network element of claim 35, further comprising a memory configured to store the signal constellation in a look-up table.

41. (Previously Presented) The network element of claim 35, wherein the signal constellation is designed based on a largest minimum Kullback-Leibler distance between signal constellation points.

42. (Previously Presented) The network element of claim 35, wherein the detector module is further configured to perform maximum likelihood demodulation.

43. (Previously Presented) The network element of claim 35, wherein the detector module is further configured to perform coherent demodulation.

44. (Previously Presented) The network element of claim 35, wherein the network element comprises part of a base station or a mobile station.

45. (Previously Presented) The network element of claim 35, wherein the detector module is configured to receive the channel state information and the signal constellation.

46. (Currently amended) A network element comprising:

means for receiving a modulated signal from a second network element;

means for selecting a signal constellation based on a channel state information and based on a signal to noise ratio; and

means for demodulating the modulated signal by selecting a point from the signal constellation corresponding to the modulated signal.

47. (Currently amended) A detection module comprising:

an input component configured to receive a signal; and

a detection component configured to select a signal constellation based on a channel state information and based on a signal to noise ratio and to demodulate the ~~modulated~~ received signal by selecting a point from the signal constellation corresponding to the ~~modulated~~ received signal.

48. (Currently amended) The detection module of claim 47, wherein the input component is further configured to receive [[a]] the channel state information ~~estimate~~, [[a]] the signal-to-noise ratio, and the signal constellation.

49. (Currently amended) A computer-readable medium having computer-readable instructions stored thereon that, when executed by a processor, cause a computing device to:

receive a modulated signal;

select a signal constellation based on a channel state information and based on a signal to noise ratio; and

demodulate the modulated signal by selecting a point from the signal constellation corresponding to the modulated signal.

50. (Previously Presented) The computer-readable medium of claim 49, wherein the signal constellation is designed based on a largest minimum Kullback-Leibler distance between signal constellation points.

51. (Currently amended) A method for communicating a signal, the method comprising:

selecting a point from a signal constellation at a selection module based on a channel state information and based on a current signal to noise ratio;

modulating the signal at a modulator using the selected point; and

transmitting the modulated signal from a first network element to a second network element.

52. (Canceled)

53. (Currently amended) A network element comprising:

a selection module configured to select a point from a signal constellation based on a channel state information and based on a current signal to noise ratio;

a modulator configured to modulate the signal using the selected point; and

a transmitter configured to transmit the modulated signal to a second network element.

REMARKS

Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow. Claims 1-25 were previously canceled, and Claims 26-53 were added. Claims 27, 36, and 52 are currently requested to be canceled. Claims 26, 35, 46, 47, 49, 51, and 53 have been amended to include the elements of now canceled Claims 27, 36, and 52. Claims 28, 30, 38, 39, and 48 have been amended to correct the antecedent basis solely as a result of the amendments to Claims 26, 35, and 46. Thus, no new search or consideration is required by the Examiner. Therefore, Applicants respectfully submit that entry of the amendments is proper. Claims 26, 28-35, 37-51, and 53 are now pending in this application.

I. Rejection of Claims 26, 27, 30, 31, 35, 36, 39, 40, 44-49, and 51-53 Under 35 U.S.C. § 102

In section 5 of the Office Action, Claims 26, 27, 30, 31, 35, 36, 39, 40, 44-49, and 51-53 were rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,560,445 to Fette *et al.* (*Fette*). Applicants have amended Claims 26, 35, 39, 46-49, 51, and 53 without prejudice to or disclaimer of pursuing the subject matter of these claims in a continuation or other application. Claims 26, 35, 46, 47, 49, 51, and 53 have been amended to include the features of now canceled Claims 27, 36, and 52. Applicants respectfully submit that *Fette* fails to teach, suggest, or disclose all of the elements of at least independent Claims 26, 35, 46, 47, 49, 51, and 53, as amended.

Claim 26 recites in part:

> selecting a signal constellation, at a communication device, based on a channel state information **and** based on a current signal to noise ratio;

(Underlining and bolding added). Claims 35, 46, 47, 49, 51, and 53, though of different scope recite a similar feature.

On page 3 of the Office Action, the Examiner states:

> Regarding claims 26, 27, 30, 31, 35, 36, 39, 40, 45-49 and 51-53, Fette discloses a method of and apparatus for processing a received space-time constellation. The signal to noise ratio (SNR) of each coefficient is used to determine the constellation that will be used for transmission (column 8, lines 20-51). The receiver will transmit the channel conditions to the transmitter (abstract) and "in response to predetermined conditions selects

> a cepstral constellation to be utilized." (abstract). The receiver will demodulate the received signal to recover the transmitted data.

(Underlining added). *Fette*, however, fails to teach, suggest, or describe at least "selecting a signal constellation, at a communication device, based on a channel state information **and** based on a current signal to noise ratio" (underlining and bolding added) as recited in independent Claims 26, 35, 46, 47, 49, 51, and 53.

Relative to selection of a constellation, *Fette* states:

> Receiver 1003R includes a processor that initially, at step 901 selects a first SNR in the range of SNR for the expected communication environment of communication link 1005FIG. 18) is selected. .... In other words, at step 905, SNR is measured for each cepstral coefficient. At step 907 candidate constellations are selected. At step 909 the information carrying capacity of each constellation is analyzed under the SNR. At step 911, a constellation is selected that delivers the highest information rate subject to an upper bit error rate bound of the associated forward error correcting code. .... As receiver 1003R assesses the performance of the demodulation constellation on a live signal, it selects a model of SNR nearest to the actually received SNR, and signals transmitter 1001T via transmitter 1003T and second link 1007 to receiver 1001R of selected constellations for that SNR. As transmitter 1001T shifts to that constellation, receiver 1003R invokes the appropriate constellation for the current SNR, thereby enabling the maximum available throughput performance under current link conditions.

(Col. 9, lines 17-66). Thus, according to *Fette*, the constellation can be selected based on a SNR. However, *Fette* fails to provide any teaching of at least "selecting a signal constellation, at a communication device, based on a channel state information and based on a current signal to noise ratio" as now recited in independent Claims 26, 35, 46, 47, 49, 51, and 53.

For at least this reason, Applicants respectfully submit that *Fette* fails to teach, suggest, or describe all of the elements recited in at least independent Claims 26, 35, 46, 47, 49, 51, and 53. A rejection under 35 U.S.C. § 102 cannot be properly maintained where the reference fails to teach each and every element of the rejected claims. The remaining claims depend from one of Claims 26, 35, or 47. For at least these reasons, Applicants respectfully request withdrawal of the rejection of Claims 26, 30, 35, 36, 39, 40, 44-49, 51, and 53.

II. Rejection of Claims 28, 29, 37, and 38 Under 35 U.S.C. § 103(a)

In section 6 of the Office Action, Claims 28, 29, 37, and 38 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Fette* in view of U.S. Patent Publication No. 2002/0090035 to Seshadri *et al.* (*Seshadri*). Applicants respectfully disagree because *Fette* and *Seshadri*, alone and in combination, fail to teach, suggest, or disclose all of the elements of at least independent Claims 26 and 35 from which Claims 28, 29, 37, and 38 depend.

As discussed in Section I. above, *Fette* fails to teach, suggest, or disclose all of the elements of independent Claims 26 and 35. *Seshadri* fails to remedy the deficiencies of *Fette*.

Seshadri a method "used to generate set partitioning structures and trellis structures that enable code designers to systematically design the codes of the invention." (Abstract). *Seshadri* states:

> Once the rate has been selected, other aspects of the communications system and code are fixed. For example, a rate of 1 bit/second/hertz means that the system will have a constellation size of 2 (a BPSK system). A rate of 2 bits/second/hertz means the system will have a constellation size of 4 (a QPSK system). A rate of 3 bits/second/hertz means that the system will have a constellation size of 8 (an 8-PSK system). In general, the constellation size (L) will equal 2.sup.b, where b represents the selected rate. Also, as described herein, once the rate is selected, the number of input bits provided to lookup table 506 is 2b. Thus, selecting a rate is an important design consideration.

(Para. [0083]; underlining added). Thus, according to *Seshadri*, the constellation can be selected based on a rate where the "selected rate represents the number of bits transmitted in a given period of time." (Para. [0082]). However, *Seshadri* fails to provide any teaching of at least "selecting a signal constellation, at a communication device, based on a channel state information and based on a current signal to noise ratio" as now recited in independent Claims 26 and 35.

Thus, *Fette* and *Seshadri*, alone and in combination, fail to teach, suggest, or disclose all of the elements of at least independent Claims 26 and 35. An obviousness rejection cannot be maintained when the combination of references cited fails to teach each and every element recited in the claims. As a result, Applicants respectfully request withdrawal of the rejection of Claims 28, 29, 37, and 38, which depend from Claims 26 and 35.

III. Rejection of Claims 32, 41, and 50 Under 35 U.S.C. § 103(a)

In section 7 of the Office Action, Claims 32, 41, and 50 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Fette* in view of Dabak *et al.*, "Signal Constellations for Non-Gaussian Communication Problems", Proceedings of the 1993 IEEE International Conference on Acoustics, Speech, and Signal Processing, April 27-30, 1993, Minneapolis, Minnesota, 33-36 (*Dabak*). Applicants respectfully disagree because *Fette* and *Dabak*, alone and in combination, fail to teach, suggest, or disclose all of the elements of at least independent Claims 26, 35, and 49 from which Claims 32, 41, and 50 depend.

As discussed in Section I. above, *Fette* fails to teach, suggest, or disclose all of the elements of independent Claims 26, 35, and 49. *Dabak* fails to remedy the deficiencies of *Fette*.

Dabak describes a "procedure for determining optimum signal sets." (Abstract). *Dabak* states that "[o]ptimum signal constellations depend on signal-to-noise ratio." (Abstract). *Dabak* further states that "[f]or small M, we can calculate optimal signal sets by maximizing the sum of all intersignal distance measures under a signal-related constraint." (Page 34, Section 3). However, *Dabak* fails to provide any teaching of at least "selecting a signal constellation, at a communication device, based on a channel state information and based on a current signal to noise ratio" as now recited in independent Claims 26, 35, and 49.

Thus, *Fette* and *Dabak*, alone and in combination, fail to teach, suggest, or disclose all of the elements of at least independent Claims 26, 35, and 49. An obviousness rejection cannot be maintained when the combination of references cited fails to teach each and every element recited in the claims. As a result, Applicants respectfully request withdrawal of the rejection of Claims 32, 41, and 50, which depend from Claims 26, 35, and 49.

IV. Rejection of Claims 33, 34, 42, and 43 Under 35 U.S.C. § 103(a)

In section 8 of the Office Action, Claims 33, 34, 42, and 43 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Fette* in view of U.S. Patent No. 6,674,820 to Hui *et al.* (*Hui*). Applicants respectfully disagree because *Fette* and *Hui*, alone and in combination, fail to teach, suggest, or disclose all of the elements of at least independent Claims 26 and 35 from which Claims 33, 34, 42, and 43 depend.

As discussed in Section I. above, *Fette* fails to teach, suggest, or disclose all of the elements of independent Claims 26 and 35. *Hui* fails to remedy the deficiencies of *Fette*.

Hui a method "in which, over each synchronization signal period or other determinate information window, the channel coefficients and the color of the baseband noise are concurrently estimated." (Abstract). *Hui* states:

> To extract the transmitted signal (or symbols) from the received signal, the receiver of a mobile terminal typically includes a demodulator which may be a coherent demodulator such as a maximum likelihood sequence estimation (MLSE) demodulator (or equalizer). To adapt to the channel variation from each data burst to the next, an associated channel estimator is typically provided for the demodulator. The channel estimator typically operates using known transmitted symbols.

(Col. 1, ll. 57-65). However, *Hui* fails to provide any teaching of at least "selecting a signal constellation, at a communication device, based on a channel state information and based on a current signal to noise ratio" as now recited in independent Claims 26 and 35.

Thus, *Fette* and *Hui*, alone and in combination, fail to teach, suggest, or disclose all of the elements of at least independent Claims 26 and 35. An obviousness rejection cannot be maintained when the combination of references cited fails to teach each and every element recited in the claims. As a result, Applicants respectfully request withdrawal of the rejection of Claims 33, 34, 42, and 43, which depend from Claims 26 and 35.

V. Double Patenting Rejection

In section 9 of the Office Action, Claims 26, 27, 30-32, 35, 36, 39-41, and 45-53 were provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over Claims 41, 42, 45, 49, 50, and 57-58 of U.S. Patent Application No. 10/671,346. Applicants respectfully request that the double patenting rejection be held in abeyance until the pending claims are otherwise determined to be in condition for allowance. If the claims are otherwise found to be in condition for allowance, Applicants will review the claims at that time and determine whether a terminal disclaimer is appropriate.

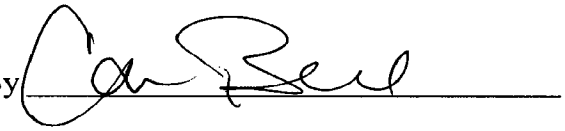
Applicants believe that the present application is in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by the credit card payment instructions in EFS-Web being incorrect or absent, resulting in a rejected or incorrect credit card transaction, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicants hereby petition for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

Date September 8, 2009

By 

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